Motion Events in English and Polish Monolinguals and Bilinguals

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Abstract

When classifying motion events, speakers classify motion in language-specific ways. In the following study, we asked whether bilingual speakers shift their event classification preferences based on the language in which they verbally encoded those events. Polish-English bilinguals, English-Polish bilinguals, and English monolinguals described events in either Polish or English. Additionally, they judged the similarity of motion events in a triad task. Participants who performed the task in English mentioned manner more often in their verbal responses than Polish participants. In the similarity judgement task, judgement was modulated in bilinguals by the age of acquisition of the second language. The younger age English was acquired, the more the participants were likely to judge similarity based on manner.

Introduction

The question of whether language influences perception is one of the most disputed topics in the area of Language and Thought. The birth of this debate can be attributed to one of the pivotal claims in linguistics: the Sapir-Whorf Hypothesis, according to which a person's thoughts and actions are determined by the language or languages that they speak. Although this claim has since been refuted in its strong form (linguistic determinism), it does however provide a fundamental basis of linguistic relativity, which claims that speakers of different languages differ in certain ways of thinking about the world and conceptualizing events, at least when preparing for verbalization. Currently, research in linguistics is looking to identify specifically in which areas of cognition the language influences thought, and where its influence may not be evident. To discover this answer, we seek to clarify the following question: how do language-

specific patterns of motion conceptualization influence the way speakers of such languages perceive motion?

Conceptualization of Motion Across Languages

Through the years, many studies have demonstrated that languages may exert a certain influence over the way people think about, categorize, and perceive motion. Most research in this area focused on the typology suggested by Talmy (1985), who divided languages into categories depending on how they encode motion. Specifically of interest are the verb-framed languages (V-type) and satellite-framed languages (S-type). In verb-framed languages, the path of motion is encoded in the motion verb (e.g in Spanish 'la botella entro´ a la cueva (flotando)' [the bottle moved into the cave] (Schmiedtova et al. 2011)) while the manner of motion is encoded outside the verb, if at all (e.g., in Spanish, now with manner, 'la botella entro´ a la cueva (flotando)' [the bottle moved into the cave [floating]). In satellite-framed languages, the manner of motion (i.e. how the object moves) is encoded in the main verb, whereas the path of the object is encoded outside the main verb in a 'satellite', such as a preposition or an adverb (e.g. in Polish 'żaba wskoczyła do wody' [the frog jumped into the water]). Importantly, while the two types of languages differ in encoding of both path and manner, both languages always encode path in their motion description, while the encoding of manner is less obligatory. Additionally, it is worth pointing out that the membership of a language in either of the classes (S-type or V-type) is a statistical trend, rather than an absolute rule. Indeed, both S- and V-type languages possess both manner- and path-encoding verbs, but differ in the frequency of their use, as well as other factors, which are beyond the scope of this paper.

Slobin in his influential Thinking-for-Speaking hypothesis (Slobin, 1996) suggested that the conceptualization of motion is different in native speakers of different languages when they

prepare for verbalization. Specifically, cross-linguistic differences reveal themselves in the aspects of visual scenes that speakers pay attention before describing them: they focus on those aspects of visual scenes that would need to be mentioned when describing the scene in their native language. For example: English speakers emphasize the path (or trajectory) an object takes, while leaving the end-state implicit, while Spanish speakers assert an end-state, while implying the trajectory of the object. Following this hypothesis, S-type language speakers represent manner and directed motion as a single conceptual event compared to V-type language speakers. Additionally, s-type language speakers tended to pay more attention to motor patterns, rate, and quality of movement, meaning that they appear to have more mental imagery related to manner of movement (Slobin, 1996).

Talmy's typology, although influential, has caused debate over the usefulness of such strict classification of languages. For example, Pavlenko (2015) argues that it is not always possible to neatly attribute each language to a particular category. For example, English exhibits traits of both S- and V-type languages. As Pavlenko points out in her criticism a study by Bohnemeyer et al. (2006), attributing a certain subtype to a language is challenging when considering only the frequency and number of manner or non-manner verbs, since this factor can vary depending on the task. Instead, comparing a language based on its attention to manner, may contribute to a better classification. For example, in Polish, marking of manner in the verb is near-obligatory, and therefore marking of motion is confined to a narrow process. However, in English, where marking of manner is optional, a wide range of motion encoding is permitted. Despite the fact that English may follow both s-type and v-type traits, the way in which manner of motion is obligatory in Polish, establishes a fundamental difference in the ways in which manner in motion events is attended to.

Motion Event Conceptualization in Polish and English

English and Polish differ in their motion encoding when it comes to their method of encoding motion in the language. English can often be considered a language where manner encoding is more prominent. However, manner encoding is not always obligatory, as evidenced by the high frequency of the use of verbs such as *go, come*, etc. (Pavlenko 2015), which do not specify the manner of motion. For example, it is sufficient enough to say, "She is going to the store." without encoding the manner of the motion event. In contrast to English, Polish requires a more obligatory description of manner, and only very rarely encodes verbs that are unmarked for manner e.g. *przybyć* 'arrive,' *przemieszczać* 'translocate/move'. For example, the same sentence, would translate to, *Ona idzie do sklepu* 'She is *walking* to the store.' It would thus be revealing to compare two languages that are considered to belong to the same manner-dominant group (S-type languages), but differ in the degree of obligatoriness of manner encoding. Additionally, it would be useful to reveal whether Polish–English and English–Polish bilinguals differ from their monolingual peers, when using Polish or English, respectively.

Motion Event Conceptualization by Bilinguals

As described by Schmiedtová et al (2011), in the description of motion events speakers may rely on their L1 when talking about events in the L2. If a person's L1 is English and L2 is Polish, they may consider manner of motion to be less obligatory for encoding in Polish, and vice versa. Depending on the speaker's L1 they will tend to pattern with their respective manner encoding. However, for a bilingual speaker, depending on the proficiency of their L2 language (e.g. Polish native speakers, using their L2 English), the L1 may influence their motion

perceptions. Some findings suggest that some L2 learners can adapt to the L2 language pattern, while others, even when advanced L2 learners, may still be influenced by their L1. A particularly influential factor, however, is the age of acquisition of L2.

The age at which a second language was acquired plays a crucial role in the encoding of motion verbs. Lai et al (2013) found that bilinguals whose L1 was Spanish, and acquired English later in life, based their judgments on path more often when Spanish was used to describe the motion events versus English. Early bilinguals, had a path preference regardless of which language they were using. Spanish patterns with the v-type language manner of encoding motion, whereas, English, in comparison to Spanish, is more s-type. Late bilinguals were attributing their judgements based on their L1. By this account, there may be an effect on motion encoding depending on the age which Polish bilinguals or English bilinguals acquire their L2. Bilinguals who acquired their L2 later may have a manner of encoding motion that mirrors the respective motion encoding of their L1.

So far we have seen that native language background has certain impact on encoding mental representation of motion events. Another important aspect to be taken into account is how motion perception changes as a factor of bilingualism. The apparent way in which language influences thought raises the question of how language knowledge influences individuals who know more than one language. In other words, do bilingual speakers demonstrate a difference in their thought processes based on their knowledge of multiple languages? Is it possible that the level of dominance language(s) have on the speaker, changes the degree of influence the language has on the thought process of the speaker? To answer this question, we focused on the way in which perception of motion was influenced in Polish-English bilinguals. Specifically, we are interested in whether Polish–English and English–Polish bilinguals pattern with the monolingual

speakers of their respective languages, or whether they exhibit a conceptual shift as a result of regularly using both languages.

With this knowledge, we hope to explore how language influences perception, as well as verbal description of motion. We ask the following research questions: (1) Do native speakers of Polish mention manner more often than native speakers of English when describing motion events? (2) Are native speakers of Polish more likely to judge similarity of motion events based on manner? (3) Do Polish–English and English–Polish bilinguals select and mention manner differently as a factor of the age of acquisition of their L2? We predict that native Polish speakers will attend more to manner in comparison to native English speakers. Additionally, Polish native speakers will make their judgments based on the manner of motion, rather than on the path of motion. Depending on their L2 age of acquisition, we predict that bilinguals will attend to and make judgements based on the manner of motion that patterns more similarly with their L1.

Methods

Participants

One-hundred and twenty participants in the US, Poland, and UK took part in this study with informed consent. Fifty participants were immediately eliminated due to incomplete survey responses, nonsense responses on the experimental task, and language backgrounds. Two main bilingual groups existed in this study. Polish-English bilinguals (N=26), and English-Polish bilinguals (N=16). For the purpose of analysis, the bilingual groups were divided into four sub-groups based on native language and country of residence. Each group showed proficiency in at least two languages. Proficiency of each language was measured by averaging proficiency

answered from the demographic questionnaire. The questions were scaled from 1 to 5. A score greater than 3 indicated high language proficiency, a score less than 3 indicated low language proficiency. One group consisted of bilinguals who reside in Poland, and whose native language is Polish (N=12). Another group consisted of bilinguals who reside in the US, but whose native language is Polish (N=14). The third group consisted of bilinguals who reside in the US, and whose native language is English (N=13). Group four consisted of bilinguals who reside in Poland, but whose dominant language was English (N=3).

The monolingual participants were those who qualified as completely monolingual or 'minimally bilingual'. Participants who indicated more than one language dominance, were considered monolingual if the average proficiency score for their indicated L2 scored less than 3 on a scale from 1 to 5. The English monolinguals (N=27) either indicated English as their only dominant language, or had an L2 language other than English which scored less than 3 in proficiency. All Polish speaking participants had an L2 with a proficiency score of 3 or more, therefore there were no Polish monolinguals (N=0).

After exclusions, seventy participants from Poland and the United States remained in the final analysis (mean age – 21 years, age range 18—68 years; 52 females). (i) 27 bilinguals tested in Polish (mean age – 34 years, age range 18—68 years; 20 females; English proficiency: 4.22; Polish proficiency: 4.94) in the US and Poland; (ii) 16 bilinguals tested in English (mean age 29, age range 18—55 years; 10 females; English proficiency: 4.64; Polish proficiency: 4.48) in the US and Poland; (iii) 27 monolinguals tested in English (mean age 21, age range 18—68 years; 22 females; English proficiency: 4.98) in the US; and (iv) 0 monolinguals tested in Polish.

In addition, the age of English acquisition in bilinguals varied: 13 bilinguals started learning English before the age of 6 (age range 0–5 years), and 22 bilinguals started learning English at or after the age of 6 (age range 6–15 years).

Materials

The materials used consisted of 16 animated videos of motion events of a "red tomato man," moving across the screen from various locations in differing manners and directions across the screen. (see Allen, Ozyurek, Kita, Brown, Furman, Ishizuka & Fujii, 2007; Bohnemeyer et al., 2001). The red tomato man moved in either of the following manners of motion: twirl, roll, jump, and slide; and the motion was directed either left or right across the screen from two differing locations serving as source and destination (tree and rock, or hut and cave). Eight animations served as the target video and priming task for participants to view and describe before they were administered a similarity judgement task. The 16 videos were distributed into six lists using a Latin-square rotation, resulting in eight groupings of target video and triads per list. The order of the triad presentation was first randomized, and was presented in one order (forward) as one version of the list, and then reversed (back) as the other version of the list, resulting in 12 lists. 16 groups of filler target and triad videos (32 animated videos) were inserted in each list pseudo-randomly, to avoid the participants falling into a fixed response pattern. The filler animations consisted of two animated characters (red tomato man, green tomato, or green triangle man) interacting with each other depicting one of four actions. The actions were two events of change of possession (GIVE and THROW an instrument of a hammer or a stick) and two events of change of state (BREAK and HIT with an instrument of a hammer).

Three groups of two practice videos (description video and similarity judgement task video triad) were used, to familiarize the participants with the task. The practice triads consisted of two geometric shapes, i.e., a red circle and a blue square, interacting with each other. For example, in one of the target animations, a red circle in a container moved outside of the container. In its variants, one variant depicted the red circle moving inside into the container, and the other variant depicted a blue square moving back and forth inside the container. An English and Polish version of these tasks was created for this project.

Procedure

The participants were sent a link which asked what their native language(s) were (English, Polish, or both). Depending on the language they chose, the participants were assigned the survey in the corresponding language. If the participant chose “both,” they had the choice on which language they would take the survey. Immediately after this question, participants were directed to the consent form in their corresponding language. They provided consent in taking the study by digitally signing and dating the online form before any survey material was administered. After completing the consent form, participants were linked to the survey instructions in their corresponding language. By clicking next, the participants proceeded to the trial run to familiarize themselves with the survey task. With the completion of the trial run participants were assigned to one of twelve lists randomly.

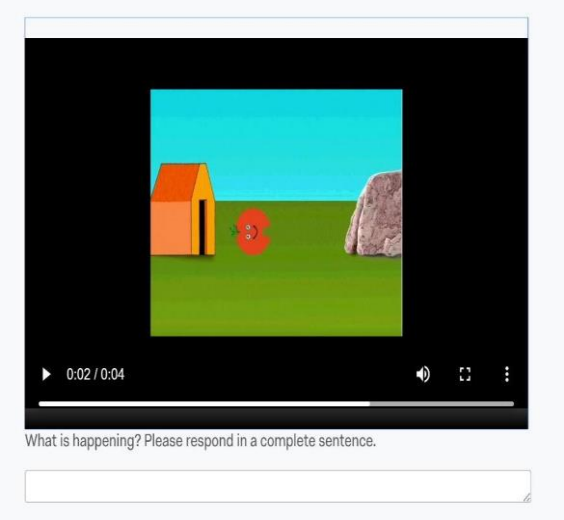

Figure 1: An example of the target video and priming task. Red Tomato Man rolling leftwards.

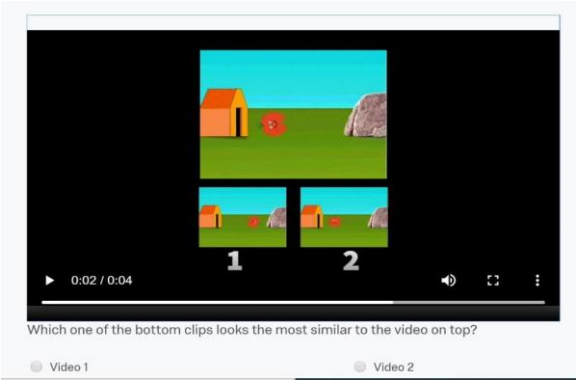

Figure 2: An example of the similarity judgement task triad. Largest video is target video from priming task. Video 1: variant—same manner, tomato man rolling rightwards.

In the experimental task, each trial consisted of a verbal description task followed by a similarity judgment task. First, the participants saw the target video (e.g. red tomato man rolling leftward) and answered the question “What is happening? Please respond in a complete sentence,” by typing the verbal description of the video. This was used to prime the participant in their native language. Refer to Figure 1 for an example. After clicking "Next," they were taken to a screen where the target video was displayed above two other videos labeled 'video 1' and 'video 2.' ‘Video 1’ depicted a motion event that had the same directed path as the target video, but a different manner (e.g. red tomato man sliding leftward). Video 2 depicted the same manner of motion, but a different path direction as the target video (e.g. red tomato man rolling rightward). Their task was to answer the question “Which one of the bottom clips looks the most similar to the video on top,” and select the video that they considered most similar to the target video. Refer to Figure 2 for an example.

The filler animations consisted of two variants: same-instrument variant and same-action variant. Like the experimental task, participants saw the target video (e.g. the green tomato man gave a hammer to the red tomato man) and answered the question “What is happening? Please

respond in a complete sentence," by typing the verbal description of the video. This was used to prime the participant in their native language. After clicking "Next," they were taken to a screen where the target video was displayed above two other videos labeled 'video 1' and 'video 2.' 'Video 1' depicted same-instrument variant (e.g. a green tomato man giving a green triangle man a hammer) and 'video 2' depicted the same-action variant (e.g. a green tomato man giving a stick to the red tomato man.) The change of state variation of the fillers used the same format (the target e.g. the red tomato man smashes the green tomato man with a hammer.) In the similarity judgement task, 'video 1' depicted same-state variant (e.g. a green triangle man smashes a green tomato man with a hammer) 'video 2' depicted different-state variant (e.g. a red tomato man hits a green tomato man with a hammer). The combination of the tomato men, their actions, and the instruments were counterbalanced.

The background of each animation and filler consisted of an animated blue sky, and green lawn with two ground objects (either tree and rock, or hut and cave). The background and ground objects remained the same for each video in the triad (e.g. hut and cave).

After completing the similarity judgement task with the animations, an extensive demographic questionnaire was administered. The questionnaire consisted of thirty-one questions pertaining to demographic and language information i.e. age, gender, native language, language dominance, etc. A Polish and English version of the questionnaire was created, and participants could switch between which language they preferred to fill the questionnaire in (either Polish or English). Some questions on the questionnaire came from the LEAP-Q (Language Experience and Proficiency Questionnaire). The rest of the questions were carefully created to elicit a full understanding of participants' language dominance and proficiency.

Results

1. Language effects in monolinguals and bilinguals

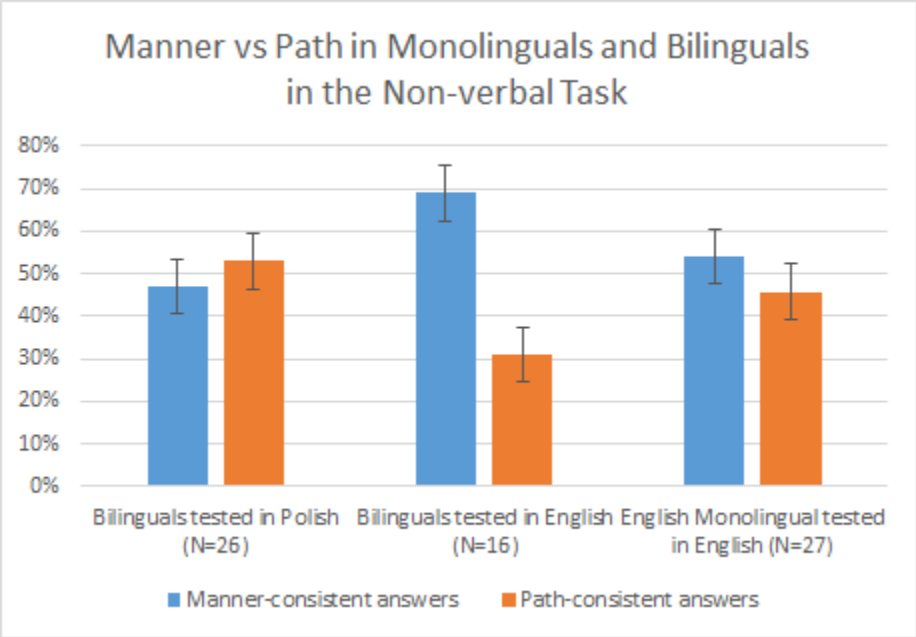

Figure 3: Manner and Path preference on non-verbal responses in participant groups.

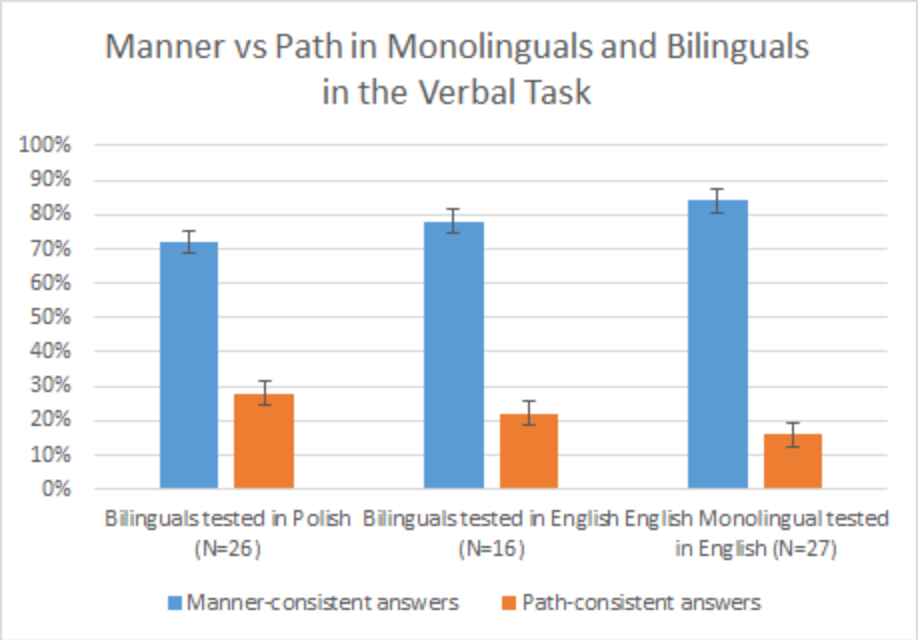

Figure 4: Manner and Path preference on verbal responses in participant groups.

The results for the non-verbal task are summarized in Figure 3. The manner preference in the non-verbal responses (from the non-verbal similarity judgement task) were 54% (SD=50%) for the English monolinguals, 69% (SD=48%)for the bilinguals tested in English, and 47% (SD=50%) for the bilinguals tested in Polish. The results for the verbal task are summarized in Figure 4. The manner preference in the verbal responses (from the verbal description task) were 84% (SD=37%) for the English monolinguals, 78% (SD=42%) for the bilinguals tested in English, and 72% (SD=45%) for the bilinguals tested in Polish.

To analyze the data, we carried out mixed-effects logistic regression analyses (Baayen, 2008). Our first question was whether the task language (Polish, English) and/or the language background (monolingual, bilingual) could predict bilinguals' non-verbal similarity judgment preference (same path, same manner) or verbal descriptions (whether or not the manner of

motion was mentioned) while controlling for the random variables of subject and item, and the experimentally controlled variables: type of ground (hut–cave, tree–rock), direction of motion (left, right), manner of motion in the target clip (twirl, jump, slide, roll), type of manner contrast shown in the target clip and the variant clip (twirl–roll, twirl–jump, twirl–slide, jump–slide, jump–roll, slide–roll).

We found no effect of survey language on non-verbal responses when tested all participants (bilinguals and monolinguals) (p>.05). However, in verbal responses there was a main effect of survey language (β=1.59, z=3.61, p<.001), such that participants who performed the task in English mentioned manner more often in their responses. We also found a main effect of Target Manner (β=2.73, z=4.35, p<.001). When the manner of motion in the target video was 'slide,' all participants regardless of test language or language background were more likely to mention path rather than manner. There was also a marginal effect of the manner of motion 'roll' (β=–1.44, z=–1.92, p=.05) such that when in the target video the manner was 'roll,' participants were more likely to mention manner, rather than path, regardless of language in which they took the survey.

Next, we were interested whether the survey language (English, Polish) predicted verbal and non-verbal responses in the bilinguals groups. Since we lacked a Polish monolingual group, we were not able to analyze the interaction of survey language by bilingualism status (monolingual, bilingual).There was no effect of survey language in bilinguals on the non-verbal task (p>.2). However, on the verbal task, there was an effect of survey language in bilinguals (β=1.30, z=2.15, p=.03)**.** Bilinguals who completed the task in English were more likely to mention manner in their verbal descriptions compared to those who completed the task in Polish. This finding counters our claim that Polish is more manner salient than English.

The analyses so far do not demonstrate our predictions in Polish–English bilinguals. The results go against predictions overall (both verbal and non-verbal): those who completed the task in Polish mentioned manner less often. The overall model showed that in the verbal task, participants were more likely to classify motion events on the basis of the manner of motion when using English to encode motion events and less likely to do so when using Polish. This response of event encoding by English speakers carried over in the event representations in bilinguals.. Finally, we saw the lack of effect of the controlling variable "type of ground" (sources and goals) in all the analyses, as expected.

2. **Age of acquisition effects in Bilinguals**

We investigated whether the age of acquisition of English and Polish influenced the effects of test language observed within the bilingual groups. We found that in the non-verbal task the age of acquisition of English predicted the likelihood of choosing a manner-consistent answer in bilinguals (β=.57, z=2.49, p=.01). The verbal responses were not predicted by age of acquisition of either language. Summarizing, the younger age English was acquired, the more the participants were likely to judge similarity based on manner.

Discussion

The present study tested whether the task language, as well as language background influenced verbal and non-verbal performance in Polish and English bilinguals. Specifically, we employed a forced-choice similarity judgment task with verbal encoding. We also tested a group of English monolinguals for comparison, but ultimately lacked a group of Polish monolinguals for comparison.

The primary finding of this study was that when it came to non-verbal responses, there was no effect of survey language on any of the participants. However, in verbal responses, survey language was a significant factor. The bilinguals, who were native speakers of English, encoded manner more often than native speakers of Polish. Additionally, English monolinguals had a preference towards manner encoding. Therefore, English-dominant participants were more likely to use manner in their verbal descriptions than Polish-dominant participants. In addition, the analyses showed that participants who were tested either language in the verbal task, had a preference for path when the "slide" manner appeared in the target clips, and a marginal preference for manner when "roll" manner appeared in the target video. It is possible that the "slide" motion is inherently less manner, while the "roll" motion is very manner prominent.

It is not unlikely for English monolinguals to have a preference towards manner when encoding motion verbs. After all, according to Talmy's typology, English is considered to be s-type in addition to v-type (Talmy, 1985, 2000). But, why, in this case, was the manner of motion more obligatory for the native English speakers? One possibility is the study design. There were several different manners of motion to view in the video stimulus i.e. slide, roll, jump, and twirl, while there were only two forms of directionality i.e. left or right. Perhaps the lack of differentiating path in the study design could influence English participants in judging the manner of motion as more salient. Additionally, Polish participants tended to use verbs that were unmarked for manner. Many of the verbal descriptions done by Polish native speakers included verbs like *przemieszczać* 'translocate/move'. It is possible that the study design influenced this type of response. Bohnemeyer et al (2006) had used similar stimuli on a study, and found that Polish native speakers encode manner (Same manner choice = 85%). Different from the current study that tested bilinguals, Bohnemeyer et al (2006) focused on Polish native

speakers. This study used a triad of videos where the target video was displayed first, and two variants followed 1 second after the target-clip presentation ended. Additionally the video contained four manners of motion—spin, roll, bound, slide—and two directed paths—up/right, down/left—since the stimuli in this case was depicted rolling up or down a ramp. The place of residence, could be a factor, as well. The majority of Polish native speakers in this study resided in the US, and perhaps they had a tendency to mark motion like v-type English.

A secondary finding was that age of acquisition of L2 had a significant effect for bilinguals. Bilinguals learning English at a younger age were more likely to judge the stimulus as more similar based on its manner in the non-verbal task. Thus, the younger English was acquired by a Polish speaker, the more likely they based the comparison on manner. This same effect, however, was not observed in the verbal responses provided by bilingual participants. Many of the native Polish speakers reside in the US, therefore, many of the speakers may be heritage speakers of English, who reside in English speaking countries. This factor could ultimately influence results.

We took a closer look at the country of residence of our participants. Among English monolinguals, 100% of participants resided in the United States (N=27). Among English–Polish bilinguals, 81% of the participants lived in the US (N=13), and 19% of the participants lived in Poland (N=3). Among Polish–English bilinguals, 54% of the participants lived in the US (N=14), whereas, 46% of the participants lived in Poland (N=12).

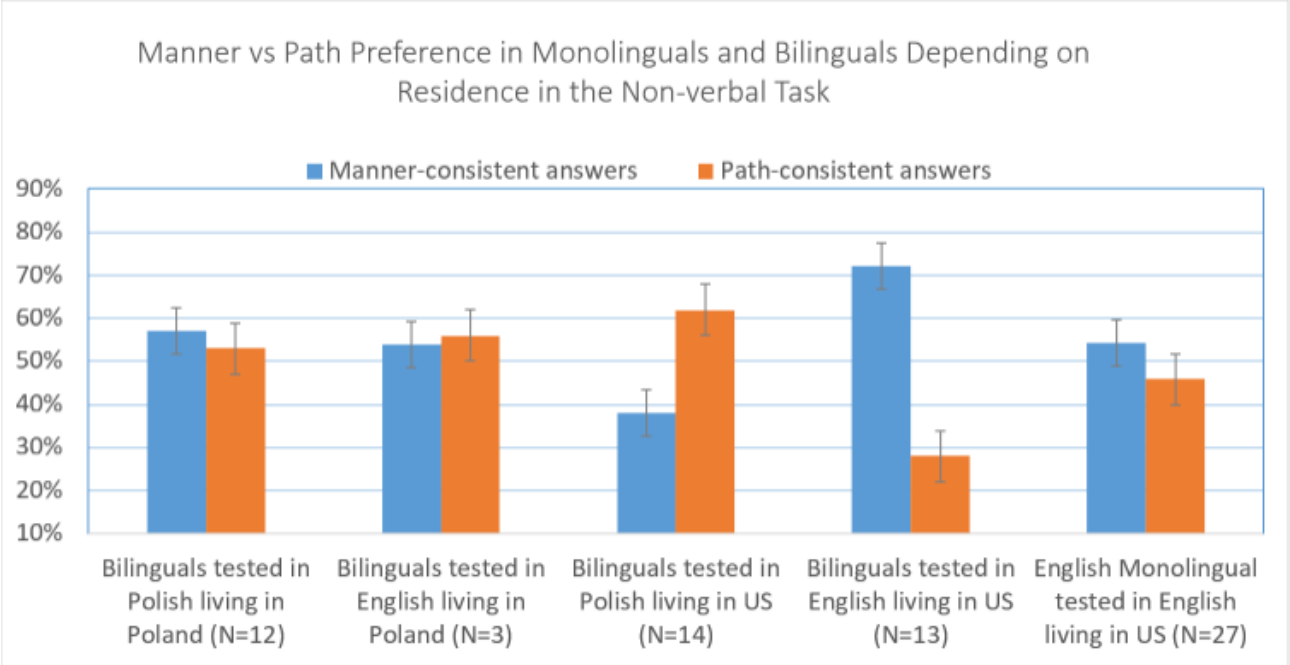

Figure 5: Manner and Path consistent answers in the non-verbal task in participants based on country of residence.

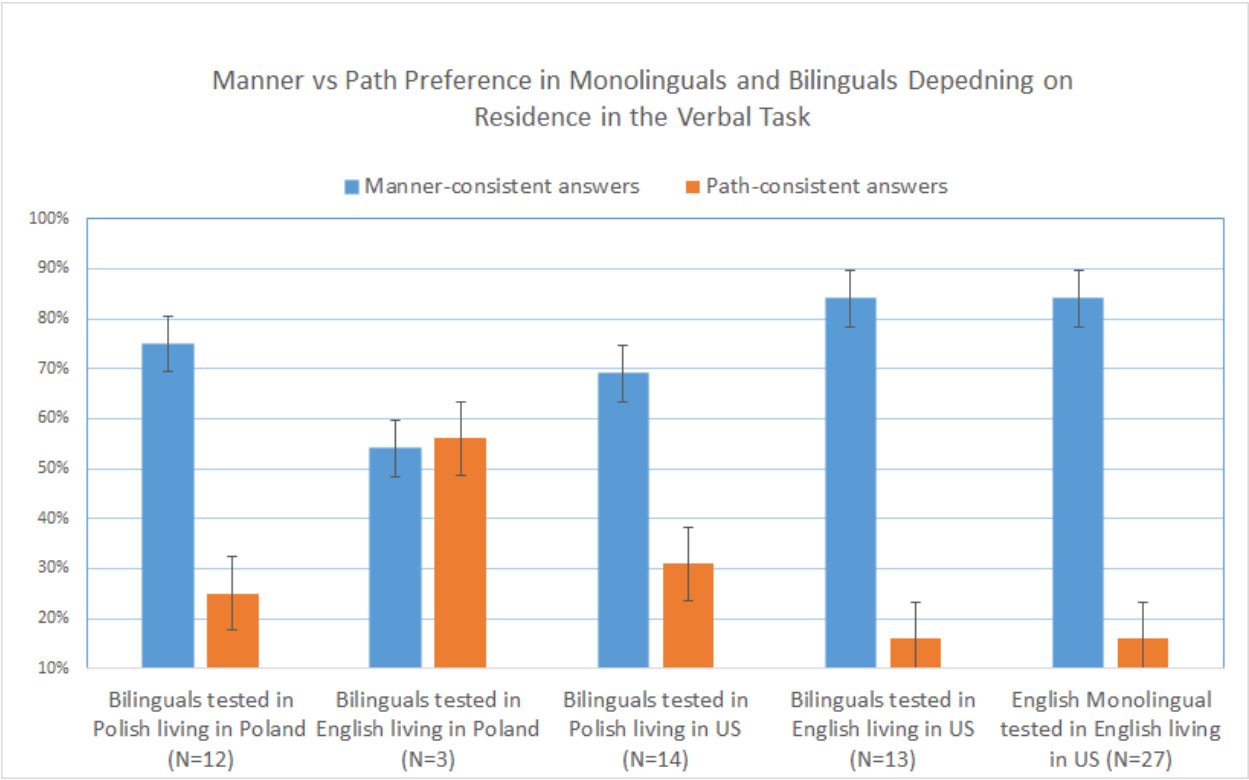

Figure 6: Manner and Path consistent answers in the verbal task in participants based on country of residence.

As shown in Figure 5, in the non-verbal task, the bilinguals that were tested in Polish, and lived in Poland judged similarity based on manner 57% (SD=50%)of times (i.e. above chance level) and mentioned manner in their verbal descriptions, Figure 6, 75 % (SD=44%)of the time. When looking at the bilinguals that were tested in Polish but resided in the U.S. in the non-verbal task, we see that their preference for manner is only at 38 % (SD=49%) in the non-verbal task and at 69 % (SD=47%) on the verbal task. Although both groups were proficient in both languages, we speculate that Polish–English bilinguals residing in Poland differ from those residing in the U.S. Those who live in Poland live in a Polish-speaking environment and Polish is their truly dominant language that is used every day in most social situations. Those living in the U.S. are most likely heritage speakers. These heritage speakers may be native Polish speakers, although their L2 English greatly influences their everyday language and attention to language.

Bilinguals tested in English and residing in the US stayed relatively consistent in their answers in both the non-verbal and verbal task (non-verbal: 72% “same-manner” (SD=47%); verbal: 84% “same-manner” (SD=38%)). Bilinguals tested in English, but residing in Poland, for the most part had an equal split in “same-manner” vs. “same-path” preference (non-verbal: 54% “same-manner”(SD=51%); verbal: 54% “same-manner”(SD=51%)). It is important to note, however, that this group had very few participants (N=3).

In summary, it appears that country of residence could be the underlying reason for our findings that went against our predictions. Indeed, the bilinguals residing in Poland were almost

twice as likely to select manner in the non-verbal task and 6% more likely to mention manner in their verbal descriptions compared to bilinguals residing in the United States trend that is in line with our original predictions. In addition, the native Polish speakers residing in Poland who completed the task in English showed an intermediate result between the other two bilingual groups. Even though we did not find statistical significance of the country of residence, we note that sample sizes were too small to obtain reliable results on the statistical tests and thus further research is needed.

The results of the study summarized so far indicate that, contrary to our predictions, English, rather than Polish, was predictive of the choice of manner in the non-verbal task, as well as mentioning manner in the verbal task. Several other studies have indicated that Polish should be predictive of choice of manner. (Ewert & Krzebietke, 2015; Bohnemeyer et al, 2006; Czechowska & Ewert, 2011). Although these studies did differ in their method of testing. While Ewert & Krzebietke (2015) and Bohnemeyer et al (2006) did have participants complete a forced choice similarity judgement task their approach was different. The former used still pictures on which participants formed a judgement. The latter tested a group of Polish native speakers (N=12). Czechowska & Ewert (2011) used a short cartoon to elicit oral narratives from participants. In this study the monolingual group was tested once (Polish monolinguals and English monolinguals), while the bilingual group (Polish second language users of English) performed the experiment twice with at least a one-week interval.

How can we explain the results that we obtained from this experiment? First the design of the similarity judgement task could bias the participants. The triad presentation of the similarity judgement task may have influenced a higher likelihood to choose the path agreeing video. Participants may have unknowingly been biased into choosing a more path oriented

response. Many studies using a similarity judgement task (Lai et al, 2014; Bohnemeyer et al, 2006; Ewert & Krzebietke, 2015) all had participants judge similarity by selecting from two videos that were shown after the target video. The triad design in this study may have caused disruption in analysis by forcing participants to attend to yet another stimulus simultaneously, since all three videos were playing at once. Although, participants had the option to replay the videos as many times as necessary. In other words, having three videos playing at once may have been sensory overload. Therefore, rather than focus on salient aspects of motion encoding, participants may have just attended to what seemed like the most obvious incongruence in the task.

Second the Polish bilingual group lacked a Polish monolingual group to analyze for comparison, putting more constraints on the analysis of the bilingual group. For example, Czechowska & Ewert (2011) found that Polish monolinguals behaved like English monolinguals, in that manner was the primary domain by which speakers in both those languages categorize motion. Although it is important to note that it is increasingly more difficult to select for pure Polish monolinguals, as most have some sort of L2. In the former study, Polish monolinguals were chosen on the basis that they were not at all proficient in English, and their L2 was a language other than English. Additionally, each bilingual group had unequal amounts of subjects (Polish-English bilinguals N=26, English-Polish bilinguals N=16). In other words, our sample sizes likely lacked power to reveal the actual language effects. Having more congruent sample sizes may show a greater effect.

Other effects could be caused by the parameters set by us. For example, this study was completely carried out online. It is possible that the lack of in-person communication with the participants could have influenced their results. A person monitoring the process could ensure

that participants maintain attention to the task. When a participant comes to a lab in-person, the experimenter may control for the language environment by speaking in a certain language with participants. It is possible that on their own, participants may not have the proper priming in the language of the task. For example, they may take the survey in Polish, but be in an English residing country, and therefore an English speaking 'mode.' Additionally, an in-person study could ensure that participants take breaks when necessary, and stick to a schedule. Another influence could be in the rating of language proficiency. Language proficiency was marked by a score greater than 3 using a scale from 1—5. In a study by Lai et al (2014), monolinguals who spoke a second language too well and rated the second language as equal or greater than 1.5 on a 1–5 scale were excluded. In this study participants were considered monolinguals if they spoke a second language that was rated as 3 or less on a 1—5 scale. It is possible that these 'monolingual' participants were influenced more by their second language. Although, most of these monolinguals did have a second language of Spanish, a v-type language.

Conclusion

In conclusion, we did find that survey language did seem to matter, specifically when the verbal task was performed in English, where participants had a tendency to choose manner. The age of acquisition of English for bilinguals also played a role in the similarity judgment task, as it seemed earlier exposure to L2 English influenced a judgement based on manner. In future studies, we hope to find a more efficient study design that may not influence participants, or perhaps resort to in-person testing. Additionally, it will be crucial to balance out each bilingual

group. We hope to dive deeper into measuring the effect of English proficiency and age of acquisition on Polish bilinguals, to see how language knowledge influenced cognitive function.

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